APPENDIX B

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Provisional Patent Application

6391-715:

Title: SELF MANAGEMENT PROTOCOL FOR A FLY-BY-WIRE SERVICE PROCESSOR

Invs: Karl Johnson
Walter A. Wallach
Dennis H. Smith
Carl G. Amdahl

The present invention provides a multi-processor diagnostic sub-system which implements a "fly-by-wire" environmental control system for a multi-processor, fault tolerant computer system, based on industry standard components but independent of any single implementation technology. Control of all physical resources (fans, power, etc.) is done by microprocessor control. Also, a low level non-volatile means is provided to log events and other system information used to diagnose failures.

The following documents are attached and form part of this disclosure:

1. *NetFRAME Wire Service Implementation User's Guide*, Version 1.0, February 29, 1997, pp. i-vii and pp. 1-47.

2. *NetFRAME Wire Service Implementation Raptor 8 Addendum*, Version 1.0, February 28, 1997, pp. i-iv and pp.1-7.

3. *NetFRAME Wire Service Implementation Command Reference*, Version 1.0, February 28, 1997, pp. i-vi and pp. 1-101.

4. *Raptor Wire Service Architecture*, Version 1.0, January 23, 1996, pp. 1-30.

Multiple Node Service Processor Network

A means is provided by which individual components of a system are monitored and controlled through a set of independent, programmable microcontrollers interconnected through a network. Further means are provided to allow access to the microcontrollers and the interconnecting network by software running on the host processor.

Fly-by-wire

A means is provided by which all indicators, push buttons and other physical control means are actuated via the multiple node service processor network. No indicators, push buttons or other physical control means are physically connected to the device which they control, but are connected to a microcontroller, which then actuates the control or provides the information being monitored.

Self-Managing Intelligence

A means is provided by which devices are managed by the microcontrollers in a multiple node service processor network by software running on one or more microcontrollers, communicating via the interconnecting network. Management of these devices is done entirely by the service processor network, without action or intervention by system software or an external agent.

Flight Recorder

A means is provided for recording system events in a non-volatile memory, which may be examined by external agents. Such memory may be examined by agents external to the network interconnecting the microcontrollers.

Replicated components: no single point of failure

A means is provided by which no single component failure renders the monitoring and control capability of the system inoperable.

Extension by serial or modem gateway

A means is provided allowing an external agent to communicate with the microcontrollers by extending the interconnecting network beyond the physical system.

The hardware environment is built around a self-contained network of microcontrollers. This distributed service processor continuously monitors and manages the physical environment of the machine (temperature, voltages, fan status). Intrapulse makes the physical environment self managing. For example, if a fan fails, Intrapulse detects this by continuously monitoring the speed of all fans, and increases the speed of the remaining fans in close proximity to the failed fan to maintain proper cooling, and signals an event to the system management software. Since the cooling system has twice the necessary cooling capacity, the system can continue to operate until a system administrator can schedule time to replace the failed fan. And, since the fans are all hot pluggable, the failed fan can be replaced without shutting down the operating system or denying service to clients. Following replacement, Intrapulse automatically detects that the fan is now working, and returns the other fans to their normal speed.

Since fans and power supplies are N+1 redundant, they all operate well below their rated speed or capacity, which increases their operating life and reduces the probability of their failing.

The basic philosophy behind the Intrapulse architecture is that is was designed to operate as a fully self-contained subsystem within the NF9000. Unlike basic system monitoring software that is typically available with Pentium Pro servers, IntraPulse has its own processors, software, internal network and power system. Where a system monitoring application that runs on the host operating system will simply quit when that server begins to experience problems or fails, IntraPulse will

continue to operate and provide the system administrator with critical system information, regardless of the operational status of the server.

The NF9000 contains nine dedicated IntraPulse processors, each responsible for monitoring one of the system's primary subsystems. IntraPulse monitors the NF9000's main processor board, the system interface, the backplane chassis controller, the DIIM™ (Dynamic I/O Isolation Module) controller, and the remote interface card. Additional, IntraPulse maintains a system recorder, which records all system traffic in a circular NVRAM (Non-Volatile RAM) buffer. With real-time time and date referencing, the system recorder enables system administrators to re-construct system activity by accessing the log.

The IntraPulse system can be managed either locally, through a dial-up connection or through the enterprise network. The information collected and analyzed by IntraPulse can be presented to a system administrator either through NetFRAME's Maestro system management software, or through a local or dial-in terminal.

The following provisional patent applications, commonly owned and filed on the same day as the present application, are related to the present application and are incorporated by reference:

COMPUTER SYSTEM HARDWARE INFRASTRUCTURE FOR HOT PLUGGING MULTI-FUNCTION PCI CARDS WITH EMBEDDED BRIDGES (6391-704); invented by:

Don Agneta
Stephen E.J. Papa
Michael Henderson
Dennis H. Smith
Carlton G. Amdahl
Walter A. Wallach

COMPUTER SYSTEM HARDWARE INFRASTRUCTURE FOR HOT PLUGGING SINGLE AND MULTI-FUNCTION PC CARDS WITHOUT EMBEDDED BRIDGES (6391-705); invented by:

Don Agneta
Stephen E.J. Papa
Michael Henderson
Dennis H. Smith
Carlton G. Amdahl
Walter A. Wallach

ISOLATED INTERRUPT STRUCTURE FOR INPUT/OUTPUT ARCHITECTURE (6391-706); invented by:

Dennis H. Smith
Stephen E.J. Papa

THREE BUS SERVER ARCHITECTURE WITH A LEGACY PCI BUS AND MIRRORED I/O PCI BUSES (6391-707); invented by:

Dennis H. Smith
Carlton G. Amdahl
Don Agneta

HOT PLUG SOFTWARE ARCHITECTURE FOR OFF THE SHELF OPERATING SYSTEMS (6391-708); invented by:

Walter A. Wallach
Mehrdad Khalili
Mallikarunan Mahalingam
John Reed

REMOTE SOFTWARE FOR MONITORING AND MANAGING ENVIRONMENTAL MANAGEMENT SYSTEM (6391-709); invented by:

Ahmad Nouri

REMOTE ACCESS AND CONTROL OF ENVIRONMENTAL MANAGEMENT SYSTEM (6391-710); invented by:

Karl Johnson
Tahir Sheik

HIGH PERFORMANCE NETWORK SERVER SYSTEM MANAGEMENT INTERFACE (6391-711); invented by:

Srikumar Chari
Kenneth Bright
Bruno Sartirana

CLUSTERING OF COMPUTER SYSTEMS USING UNIFORM OBJECT NAMING AND DISTRIBUTED SOFTWARE FOR LOCATING OBJECTS (6391-712); invented by:

Walter A. Wallach
Bruce Findley

MEANS FOR ALLOWING TWO OR MORE NETWORK INTERFACE CONTROLLER CARDS TO APPEAR AS ONE CARD TO AN OPERATING SYSTEM (6391-713); invented by:

Walter A. Wallach
Mallikarunan Mahalingam

HARWARE AND SOFTWARE ARCHITECTURE FOR INTER-CONNECTING AN ENVIRONMENTAL MANAGEMENT SYSTEM WITH A REMOTE INTERFACE (6391-714); invented by:

Karl Johnson
Walter A. Wallach
Dennis H. Smith
Carl G. Amdahl

SELF MANAGEMENT PROTOCOL FOR A FLY-BY-WIRE SERVICE PROCESSOR (6391-715); invented by:

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